# WORK UNIT SUMMARIES

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UNITED STATES OF AMERICA

**DEFENSE TECHNICAL INFORMATION CENTER**
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Hubert E. Sauter

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Administrator
Defense Technical Information Center

# DEPARTMENT OF DEFENSE

# RESEARCH AND TECHNOLOGY WORK UNIT INFORMATION SYSTEM

REPORT ON

# WORK UNIT SEARCH: U OF C AT IRVINE CONTRACTS

DDC REPORT NO. CLS15D SEP 29, 1980

REQUESTED BY

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USER CODE: 01530

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# ACCOUNTABILITY RECORD

## RESEARCH AND TECHNOLOGY WORK UNIT INFORMATION SYSTEM

## DTIC SEARCH CONTROL NO. CLS15D

A LIST OF THE SELECTED RECORDS FOLLOW. EACH ENTRY SHOWS: (1) THE AGENCY ACCESSION NUMBER, (2) THE SECURITY CLASSIFICATION CODE OF THE REPORT, WORK, TITLE, KEYWORDS, TECHNICAL OBJECTIVE, APPROACH AND PROGRESS, (3) THE RELEASE LIMITATION CODE AND (4) THE REGRADING CODE.
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FR FORMERLY RESTRICTED DATA. INFORMATION WHICH HAS BEEN REMOVED FROM THE RESTRICTED DATA CATEGORY PURSUANT TO SECTION 142(A) OF THE ATOMIC ENERGY ACT OF 1954 AS AMENDED.

REGRADING - CONSULT WITH DTIC TO DETERMINE COMPLETE CLASSIFICATION AUTHORITY, DURATION, AND CHANGE MARKING

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DTIC SEARCH CONTROL NO. CLS15D

AGENCY                        KEY  TCH              REL   CON  RE-
ACCESSION  RPT  WRK  TLE  WRD  OBJ  APR  PRG  LIM   ACC  GRD  EVL


DAOF8948    U    U    U    U    U    U    U    NL    Y         *
DAOF9122    U    U    U    U    U    U    U    NL    Y
DAOF9230    U    U    U    U    U    U    U    NL    Y         *
DAOG0642    U    U    U    U    U    U    U    NL    Y         *
DF031200    U    U    U    *    U    *    U    NL    Y         *
DF039900    U    U    U    *    U    *    U    NL    Y         *
DF041700    U    U    U    *    U    U    U    NL    Y         *
DF047080    U    U    U    *    U    U    U    NL    Y         *
DH002424    U    U    U    U    U    U    U    GU    Y         *
DH002920    U    U    U    U    U    U    U    GU    Y         *
DH003413    U    U    U    U    U    U    U    GU    Y
DN123370    U    U    U    U    U    U    U    NL    Y         *
DN975487    U    U    U    U    U    U    U    NL    Y         *
DN980182    U    U    U    U    U    U    U    NL    Y         *

CLS15D         STATISTICS             SEP 29, 1980     (800929)

DIGRAPH     UNCLASSIFIED    CONFIDENTIAL       SECRET      TOTAL

DA                 4                 0              0          4
DF                 4                 0              0          4
DH                 3                 0              0          3
DN                 3                 0              0          3

TOTAL             14                 0              0         14
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TITLE: (U) SURFACE ACOUSTIC WAVE PROPAGATION ON MAGNETIC SUBSTRATES 14769-P

| | |
|---|---|
| PERFORMING ORGANIZATION<br>UNIVERSITY OF CALIFORNIA IRVINE<br>CA 92717 | RESPONSIBLE GOVT ORGANIZATION<br>DARCOM ARMY RESEARCH OFFICE<br>BOX 12211 RESEARCH TRIANGLE<br>PARK NC 27709 |
| PRINCIPAL INVESTIGATOR<br>MILLS, D L | ASSOCIATE INVESTIGATOR |
| TELEPHONE NUMBER<br>714-833-5220 | CONTRACT/GRANT NUMBER<br>DAAG29 77 G0101 |
| PERFORMANCE METHOD<br>GRANT | CONTRACT/GRANT AMOUNT<br>$ 15,956 |

| DATE OF SUMMARY | START DATE | ESTIMATED COMPLETION DATE |
|---|---|---|
| 21 JUN 79 | FEB 77 | FEB 79 |

| KIND OF SUMMARY | SUMMARY SECURITY | WORK SECURITY |
|---|---|---|
| COMPLETION | UNCLASSIFIED | UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 005500 | ELECTRICITY AND MAGNETISM |
| 012300 | PARTICLE PHYSICS |
| 017000 | WAVE PROPAGATION |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61102A | 1L161102BH57 | 07 |

KEYWORDS: (U) (U) FERROMAGNETIC MATERIALS ;(U) SPINNING ;(U) SURFACE WAVES ;(U) ELASTIC WAVES ;(U) ULTRASONIC WAVES ;(U) SIGNAL PROCESSING

OBJECTIVE: (U) TO CONDUCT A THEORETICAL STUDY ON THE PROPAGATION OF ULTRASONIC SURFACE WAVES COUPLED TO SPIN WAVES ON THE SURFACE OF FERROMAGNETIC SUBSTRATES, SPECIFICALLY TAKING INTO ACCOUNT THE EFFECTS OF SPIN PINNING AND OVERLAYER STRUCTURE. RELEVANCE. THE RESEARCH HAS POTENTIAL RELEVANCE TO FUTURE EXTENSIONS OF PRESENT SURFACE ACOUSTIC WAVE DEVICES FOR SIGNAL PROCESSING INTO A HIGHER FREQUENCY REGIME WHICH MAY ALSO USE THE NONRECIPROCAL NATURE OF THE ATTENUATION OF SUCH WAVES.

APPROACH: (U) A SYSTEM OF COUPLED BLOCH, MAXWELL AND MAGNETOELASTIC WAVE EQUATIONS ARE TO BE USED TOGETHER WITH AN EQUATION THAT TAKES ACCOUNT OF SPIN PINNING. ADDITIONAL BOUNDARY CONDITIONS WILL BE INTRODUCED FOR THE LAYERED STRUCTURES. ADVANCED COMPUTER ALGEBRAIC MANIPULATION TECHNIQUES WILL ALSO BE USED.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DA0F8948

TITLE: (U) COHERENT RADIATION FROM RELATIVIST IC BEAM-PLASMA INSTABILITIES 15118-P

PERFORMING ORGANIZATION
UNIVERSITY OF CALIFORNIA IRVINE
CA 92717

RESPONSIBLE GOVT ORGANIZATION
DARCOM ARMY RESEARCH OFFICE PO
BOX 12211 RESEARCH TRIANGLE
PARK NC 27709

PRINCIPAL INVESTIGATOR
BENFORD, G

ASSOCIATE INVESTIGATOR

TELEPHONE NUMBER
714-833-5011

CONTRACT/GRANT NUMBER
DAAG29-78-G-0020

PERFORMANCE METHOD
GRANT

CONTRACT/GRANT AMOUNT
$ 66,870

| DATE OF SUMMARY | START DATE | ESTIMATED COMPLETION DATE |
|---|---|---|
| 16 NOV 79 | NOV 77 | NOV 79 |

| KIND OF SUMMARY | SUMMARY SECURITY | WORK SECURITY |
|---|---|---|
| CHANGE | UNCLASSIFIED | UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 013000 | PLASMA PHYSICS |
| 005500 | ELECTRICITY AND MAGNETISM |
| 012300 | PARTICLE PHYSICS |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61102A | 1L161102BH57 | 07 |

KEYWORDS: (U) (U) COHERENT ELECTROMAGNETIC RADIATION ;(U) HIGH POWER ;(U) EXCITATION ;(U) INSTABILITY ;(U) ELECTRON BEAMS ;(U) RESONANCE ;(U) MILLIMETER WAVES ;(U) SUBMILLIMETER WAVES ;(U) EMISSION SPECTRA ;(U) RADIATION DAMAGE ;(U) X-RAY

OBJECTIVE: (U) TO OBTAIN HIGH POWER MM AND SUB-MM RADIATION BASED ON THE ELECTROMAGNETIC EMISSION FROM PLASMAS IN WHICH INSTABILITIES ARE EXCITED BY A RELATIVISTIC ELECTRON BEAM. RELEVANCE. THIS PROGRAM IS RELEVANT TO THE MM AND SUB-MM PROGRAM THAT IS UNDERWAY AT HDL AS WELL AS PROGRAMS AT OTHER DOD LABORATORIES. HDL IS ALSO INTERESTED IN THIS RESEARCH AS A SOURCE OF X-RAY RADIATION FOR THEIR RADIATION DAMAGE STUDIES.

APPROACH: (U) EXPERIMENTAL AND THEORETICAL EFFORTS WILL BE CARRIED OUT TO DETERMINE THE PRECISE BEAM-PLASMA RESONANCE, TO UNDERSTAND THE SPECTRUM OF THE EMITTED RADIATION, TO DETERMINE HOW THE PEAK OF THE RADIATION CAN BE MOVED TO SUB-MM WAVELENGTHS, AND TO DETERMINE THE INFLUENCE OF BOUNDARIES ON EMISSION SPECTRUM AND EFFICIENCY.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DA0F9122

TITLE: (U) THE EFFECTS OF SURFACE ROUGHNESS ON THE PROPERTIES OF SOLIDS 15902-P

PERFORMING ORGANIZATION
UNIVERSITY OF CALIFORNIA IRVINE
CA 92717

RESPONSIBLE GOVT ORGANIZATION
DARCOM ARMY RESEARCH OFFICE PO
BOX 12211 RESEARCH TRIANGLE
PARK NC 27709

PRINCIPAL INVESTIGATOR
MARADUDIN, A A

ASSOCIATE INVESTIGATOR
WALLIS, R F

TELEPHONE NUMBER
714-833-5011

CONTRACT/GRANT NUMBER
DAAG29-78-G-0108

PERFORMANCE METHOD
GRANT

CONTRACT/GRANT AMOUNT
$ 25,227

DATE OF SUMMARY
30 JUL 80

START DATE
JUL 78

ESTIMATED COMPLETION DATE
JUN 81

KIND OF SUMMARY
CHANGE

SUMMARY SECURITY
UNCLASSIFIED

WORK SECURITY
UNCLASSIFIED

SCIENTIFIC AND TECHNOLOGICAL AREAS
015700 SOLID STATE PHYSICS
005700 ELECTRONICS AND ELECTRICAL ENGINEERING
017000 WAVE PROPAGATION

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61102A | 1L161102BH57 | 07 |

KEYWORDS: (U) (U) SURFACE ROUGHNESS ;(U) GREENS FUNCTION ;(U) THIN FILMS ;(U) ELECTRON MOBILITY ;(U) ELECTRIC CHARGE ;(U) PLASMONS ;(U) RAYLEIGH WAVES ;(U) POLARITONS ;(U) INTERFACES ;(U) FIELD EFFECT;(U) TRANSISTORS ;(U) METAL OXIDE SEMICONDUCTORS ;(U) PHOTOEMISSION ;(U) ADHESION ;(U) VAN DER WAALS FORCES ;(U) TARGET RECOGNITON

OBJECTIVE: (U) IN ALL THE SIX CASES TO BE INVESTIGATED, ONE FUNDAMENTAL UNDERLYING QUALITY, THE DYNAMICAL GREEN'S FUNCTION, WILL BE CALCULATED. THE EFFECTS OF ROUGHNESS ARE INTRODUCED BY TRANSFORMING THE EQUATIONS OF THE GREEN'S FUNCTION INTO AN EQUATION OF AVERAGED GREEN'S FUNCTION. RELEVANCE. THE RESEARCH IS

POTENTIALLY RELEVANT TO (1) A NUMBER OF ELECTRONIC DEVICES WHERE IMAGE POTENTIAL DISTORTIONS DUE TO INTERFACE EFFECTS PLAY A ROLE, (2) ELECTRON MOBILITY IN MOSFET'S, (3) THE ENHANCEMENT OF PHOTOEMISSION BY COUPLING THE RADIATION TO SURFACE PLASMONS VIA SURFACE ROUGHNESS, (4) PHYSISORPTION AND ADHESION VIA THE CONTROL OF VAN DER WAALS FORCES, (5) LASER SPECKLE PATTERNS AND RELATED TARGET RECOGNITION PROBLEMS.

APPROACH: (U) TO INVESTIGATE THE EFFECT OF SURFACE ROUGHNESS ON (1) THE MOTION OF ELECTRONS IN THIN FILMS, (2) THE IMAGE POTENTIAL OF A POINT CHARGE IN VACUUM NEAR THE ROUGH SURFACE, (3) THE VAN DER WAALS POTENTIAL BETWEEN TWO SEMI-INFINITE SOLIDS SEPARATED BY VACUUM, (4) THE SURFACE PLASMON DISPERSION RELATIONS, (5) THE PROPAGATION OF RAYLEIGH WAVES ALONG THE STRESS-FREE SURFACE OF A SEMI-INFINITE ELASTIC MEDIUM, (6) THE ATTENUATION AND FREQUENCY SHIFT OF SURFACE POLARITONS.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DA0F9230

TITLE: (U) COHERENT RADIATION FROM RELATIVISTIC BEAM-PLASMA INSTABILITIES 16562-P

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|---|---|
| PERFORMING ORGANIZATION<br>CALIFORNIA, UNIVERSITY-IRVINE<br>IRVINE CA 92664 | RESPONSIBLE GOVT ORGANIZATION<br>DARCOM ARMY RESEARCH OFFICE,<br>DURHAM RSCH TRI PK NC 27709 |
| PRINCIPAL INVESTIGATOR<br>BENFORD, G | ASSOCIATE INVESTIGATOR<br>ROBERTSON, S |
| TELEPHONE NUMBER<br>7148335011 | CONTRACT/GRANT NUMBER<br>DAAG29-80-C-0013 |
| PERFORMANCE METHOD<br>CONTRACT | CONTRACT/GRANT AMOUNT<br>$ 69,831 |

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|---|---|---|
| DATE OF SUMMARY<br>12 DEC 79 | START DATE<br>DEC 79 | ESTIMATED COMPLETION DATE<br>NOV 81 |
| KIND OF SUMMARY<br>NEW | SUMMARY SECURITY<br>UNCLASSIFIED | WORK SECURITY<br>UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 012300 | PARTICLE PHYSICS |
| 013000 | PLASMA PHYSICS |
| 017000 | WAVE PROPAGATION |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61102A | 1L161102BH57 | 07 |

KEYWORDS: (U) (U) COHERENT RADIATION;(U) ELECTRON EMISSION ;(U) BEAMS(RADIATION) ;(U) PLASMA WAVES;(U) MILLIMETER WAVES ;

OBJECTIVE: (U) TO FULLY EXPLORE COHERENT CURVATURE EMISSION MECHANISM (THE ELECTRONS HAVE AN ORBIT RATHER THAN A CIRCULAR ORBIT) WHICH HAS BEEN OBSERVED IN HIGH PLASMA DENSITY SYSTEMS DEVELOPED AT THE UNIVERSITY OF CALIFORNIA-IRVINE. RELEVANCE. THE WORK PROPOSED IS DIRECTLY RELEVANT TO THE GENERAL GOAL OF GENERATION OF NEAR-MILLIMETER WAVE RADIATION AT HIGH POWERS AND IN THE FREQUENCY REGION UNDER INVESTIGATION. THERE IS ALSO THE POSSIBLITY OF PAYOFF IN TEMRS OF A NEW MM WAVE SOURCE.

APPROACH: (U) EXPERIMENTAL APPARATUS HAVE BEEN DEVELOPED TO

PROVIDE THE CONDITIONS OF BEAM-PLASMA INSTABILITIES. GRATING SPECTROMETERS AND A CALIBRATED RANGE OF DETECTORS HAVE BEEN DEVELOPED IN THE RANGE OF 26 GHZ TO 40 GHZ. THEORETICAL WORK IS UNDERWAY TO PROVIDE AN UNDERSTANDING OF THE STRONG EMISSION MECHANISM THAT HAS BEEN OBSERVED.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DA0G0642

TITLE: (U) MATERIALS PROPERTIES OF CRYSTALS AND CRYSTAL SURFACES

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|---|---|
| PERFORMING ORGANIZATION<br>CALIFORNIA UNIVERSITY OF IRVINE<br>CALIF | RESPONSIBLE GOVT ORGANIZATION<br>AF OFFICE OF SCIENTIFIC<br>RESEARCH NE BLDG 410, BOLLING<br>AFB, DC 20332 |
| PRINCIPAL INVESTIGATOR<br>MARADUDIN A A | ASSOCIATE INVESTIGATOR<br>MILLS D L |
| TELEPHONE NUMBER | CONTRACT/GRANT NUMBER<br>AFOSR-71-2018 |
| PERFORMANCE METHOD<br>GRANT | CONTRACT/GRANT AMOUNT<br>$ 92,989 |

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|---|---|---|
| DATE OF SUMMARY<br>22 MAY 78 | START DATE<br>FEB 71 | ESTIMATED COMPLETION DATE<br>FEB 76 |
| KIND OF SUMMARY<br>COMPLETION | SUMMARY SECURITY<br>UNCLASSIFIED | WORK SECURITY<br>UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 015700 | SOLID STATE PHYSICS |
| 013600 | QUANTUM THEORY |
| 011900 | OPTICAL DETECTION |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61102F | 9761 | 02 |

KEYWORDS:

OBJECTIVE: (U) HIGH ENERGY LASER TECHNOLOGY IS FINDING WIDE APPLICATION IN FUTURE AIR FORCE SYSTEMS. BOTH IN THE PRODUCTION OF INTENSE RADIATION AND IN THE HARDENING OF CERTAIN CRITICAL COMPONENTS TO THIS RADIATION, THE INTERACTIONS OF PHOTONS WITH MATTER IS OF EXTREME IMPORTANCE. RATHER THAN TRIAL-AND-ERROR TESTING OF A WIDE VARIETY OF MATERIALS THIS RESEARCH SEEKS A FUNDAMENTAL UNDERSTANDING OF THE QUANTUM INTERACTIONS IN AND ON CRYSTALLINE SOLIDS. A MICROSCOPIC CALCULATION WILL BE MADE OF THE TRANSVERSE EFFECTIVE CHARGE, AN IMPORTANT PARAMETER WHICH CONTROLS THE INTEGRATED STRENGTH OF THE RESTSTRAHL ABSORPTION IN

CRYSTALS. THE EFFECT OF SURFACE ROUGHNESS ON THE ABSORPTION COEFFICIENT AND REFLECTION COEFFICIENT OF RADIATION WILL BE EXAMINED. THEORETICAL STUDIES ALSO INCLUDE THE EFFECT OF THE WAVE VECTOR DEPENDENCE OF THE DIELECTRIC CONSTANT ON A NUMBER OF CRYSTAL PROPERTIES.

APPROACH:

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DF031200

TITLE: (U) LIGHT SCATTERING STUDIES OF MATERIALS PROPERTIES

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|---|---|
| PERFORMING ORGANIZATION<br>CALIFORNIA UNIVERSITY OF IRVINE CALIF | RESPONSIBLE GOVT ORGANIZATION<br>AF OFFICE OF SCIENTIFIC RESEARCH NE BLDG 410, BOLLING AFB, DC 20332 |
| PRINCIPAL INVESTIGATOR<br>USHIODA S | ASSOCIATE INVESTIGATOR |
| TELEPHONE NUMBER | CONTRACT/GRANT NUMBER<br>AFOSR-75-2760 |
| PERFORMANCE METHOD<br>GRANT | CONTRACT/GRANT AMOUNT<br>$ 42,328 |

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|---|---|---|
| DATE OF SUMMARY<br>26 OCT 78 | START DATE<br>SEP 74 | ESTIMATED COMPLETION DATE<br>DEC 76 |
| KIND OF SUMMARY<br>COMPLETION | SUMMARY SECURITY<br>UNCLASSIFIED | WORK SECURITY<br>UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS
015700 SOLID STATE PHYSICS

| | | |
|---|---|---|
| PROGRAM ELEMENT:<br>61102F | PROJECT NO:<br>2306 | TASK NUMBER:<br>A2 |

KEYWORDS:

OBJECTIVE: (U) NONDESTRUCTIVE EVALUATION (NDE), TESTING (NDT) AND INSPECTION (NDI) SAVES THE AIR FORCE MANY MILLIONS OF DOLLARS AND LIVES EACH YEAR. FROM MANUFACTURING QUALITY CONTROL THROUGH PERIODIC MAINTENANCE INSPECTION THE IDENTIFICATION OF POTENTIAL CATASTROPHIC DEFECTS IN MATERIALS HAS RECEIVED HIGH PRIORITY. ENTIRELY NEW EVALUATIVE METHODS ARE REQUIRED BECAUSE OLDER TECHNIQUES DO NOT HAVE THE SENSITIVITY AND SELECTIVITY REQUIRED TO DETECT EVER SMALLER DEFECTS IN ELECTRONIC AND STRUCTURAL MATERIAL. THIS RESEARCH EFFORT WILL PROBE THE MATERIAL PROPERTIES OF THE SURFACE BY MEANS OF RAMAN AND BRILLOUIN LIGHT SCATTERING EXPERIMENTS. THE PURPOSE OF THE PROPOSED EXPERIMENTS IS TO OBTAIN MATERIALS PROPERTIES INFORMATION IN THE FAR INFRARED AND HYPERSONIC FREQUENCIES BY MEANS OF LASER LIGHT SCATTERING.

PARTICULAR EMPHASES ARE PLACED ON THE PROPERTIES OF THE SURFACE LAYERS AND OF THIN FILMS OF SEMICONDUCTORS. SEMICONDUCTORS, METALS AND CERAMICS WHICH PLAY IMPORTANT ROLES IN DEVICE APPLICATIONS SUCH AS INTEGRATED OPTICS AND ELECTRONICS ARE CONSIDERED. ONE PARTICULAR ADVANTAGE OF LIGHT SCATTERING TECHNIQUES IS THAT NON-DESTRUCTIVE TESTING CAN BE PERFORMED ON A WELL-DEFINED LOCAL REGION OF THE ORDER OF 10-100 MICRONS.

APPROACH:

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DF039900

DTIC REPORT NO. CLS15D SEP 29, 1980
DTIC FORMAT B0075

TITLE: (U) THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH SOLID MATERIALS

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|---|---|
| PERFORMING ORGANIZATION<br>CALIFORNIA UNIVERSITY OF IRVINE<br>CALIF | RESPONSIBLE GOVT ORGANIZATION<br>AF OFFICE OF SCIENTIFIC<br>RESEARCH DIR OF ELECT/SOLID<br>STATE SCIENCES BLDG 410,<br>BOLLING AFB, DC 20332 |
| PRINCIPAL INVESTIGATOR<br>MARADUDIN A A | ASSOCIATE INVESTIGATOR |
| TELEPHONE NUMBER | CONTRACT/GRANT NUMBER<br>F49620-78-C-0019 |
| PERFORMANCE METHOD<br>CONTRACT | CONTRACT/GRANT AMOUNT<br>$ 122,042 |

| | | |
|---|---|---|
| DATE OF SUMMARY<br>07 APR 80 | START DATE<br>SEP 75 | ESTIMATED COMPLETION DATE<br>FEB 81 |
| KIND OF SUMMARY<br>CHANGE | SUMMARY SECURITY<br>UNCLASSIFIED | WORK SECURITY<br>UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS
015700 SOLID STATE PHYSICS
013600 QUANTUM THEORY

| | | |
|---|---|---|
| PROGRAM ELEMENT:<br>61102F | PROJECT NO:<br>2306 | TASK NUMBER:<br>C2 |

KEYWORDS:

OBJECTIVE: (U) AF FUNCTION-AEROSPACE COMMUNICATIONS SURVEILLANCE AND DETECTION SYSTEMS REQUIRE ELECTRO-OPTICAL DEVICES WHICH EXPLOIT THE SPECIAL PROPERTIES AND INTERACTIONS OF INFRARED RADIATION WITH SOLID STATE MATERIALS. OPPORTUNITY-INFRARED MATERIALS RESEARCH HAS HIGH POTENTIAL FOR AIRBORNE AND SATELLITE APPLICATIONS. OBJECTIVE-THIS IS A RESEARCH EFFORT TO INVESTIGATE THE MICROSCOPIC THEORY AND PHENOMENOLOGY OF THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH SOLID MATERIALS, TO INVESTIGATE FUNDAMENTAL PROPERTIES OF OPTICALLY ACTIVE ELEMENTARY EXCITATIONS IN SOLIDS, AND TO STUDY BULK AND SURFACE OPTICAL PROPERTIES AS

WELL AS NONLINEAR OPTICAL PHENOMENA IN SOLIDS. HOW WORK CONTRIBUTES-THE FAR INFRARED OPTICAL PROPERTIES OF THESE MATERIALS ARE IMPORTANT TO THE DEVELOPMENT OF INFRARED DETECTORS AND COHERENT SOURCES INTEGRATED OPTICS AND ELECTRO-OPTICAL TECHNIQUES, AND HIGH ENERGY INFRARED LASER WINDOWS AND MIRRORS AS WELL AS INTERACTIONS OF MATERIALS SUBJECTED TO LASER BEAMS.

APPROACH: (U) GENERALLY UTILIZE EXISTING AND DEVELOP NEW SOPHISTICATED THEORETICAL METHODS AND COMPUTATIONAL TECHNIQUES TO INVESTIGATE THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH SOLID MATERIALS. MORE SPECIFICALLY, STUDY- RESONANT RAMAN SCATTERING FROM INDIRECT GAP MATERIALS, ELECTRON-ELECTRON SCATTERING AND THE OPTICAL PROPERTIES OF METALS, BRILLOUIN SCATTERING FROM ACOUSTICAL PHONONS NEAR A ROUGH SURFACE, LIGHT SCATTERING FROM IV-VI COMPOUNDS NEAR STRUCTURAL PHASE TRANSITIONS, LIGHT SCATTERING FROM MAGNETIC EXCITATIONS AND RAYLEIGH WAVES ON FERROMAGNETIC SURFACES, EMISSION OF SURFACE POLARITONS IN ELECTRON TUNNELING SPECTROSCOPY, INFRARED ABSORPTION BY FREE CARRIERS IN N-TYPE SEMICONDUCTORS, INFRARED ABSORPTION BY LOCALIZED VIBRATION MODES IN CUBIC CRYSTALS, AND INTRINSIC TEMPERATURE VARIATION OF THE DAMON-ESHBACH SURFACE SPIN WAVE.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DF041700

TITLE: (U) LIGHT SCATTERING STUDIES OF THE FAR INFRARED DIELECTRIC PROPERTIESOF SEMICONDUCTORS

PERFORMING ORGANIZATION
CALIFORNIA UNIVERSITY OF IRVINE
CALIF

RESPONSIBLE GOVT ORGANIZATION
AF OFFICE OF SCIENTIFIC
RESEARCH DIR OF ELECT/SOLID
STATE SCIENCES BLDG 410,
BOLLING AFB, DC 20332

PRINCIPAL INVESTIGATOR
USHIODA S

ASSOCIATE INVESTIGATOR
LAWRENCE J

TELEPHONE NUMBER

CONTRACT/GRANT NUMBER
AFOSR-77-3222

PERFORMANCE METHOD
GRANT

CONTRACT/GRANT AMOUNT
$ 0

| DATE OF SUMMARY | START DATE | ESTIMATED COMPLETION DATE |
|---|---|---|
| 12 JUN 80 | JAN 77 | AUG 80 |

| KIND OF SUMMARY | SUMMARY SECURITY | WORK SECURITY |
|---|---|---|
| CHANGE | UNCLASSIFIED | UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 015700 | SOLID STATE PHYSICS |
| 011900 | OPTICAL DETECTION |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61102F | 2306 | C2 |

KEYWORDS:

OBJECTIVE: (U) AF FUNCTION-AEROSPACE COMMUNICATIONS SURVEILLANCE AND DETECTION SYSTEMS REQUIRE ELECTRO-OPTICAL DEVICES WHICH EXPLOIT THE SPECIAL PROPERTIES AND INTERACTIONS OF INFRARED RADIATION WITH SOLID STATE MATERIALS. OPPORTUNITY-INFRARED MATERIALS RESEARCH HAS HIGH POTENTIAL FOR AIRBORNE AND SATELLITE APPLICATIONS. SOPHISTICATED ELECTRO-OPTICAL TECHNIQUES AND CHARACTERISTICS OF NARROW BAND-GAP COMPOUND SEMICONDUCTORS OFFER PROMISE FOR ELECTRO-OPTICAL MICROCIRCUITRY IN THE SPECTRAL RANGE 10 TO 100 MICROMETERS. OBJECTIVE-THE MAIN PURPOSE OF THIS RESEARCH IS TO EXPLORE THE FAR INFRARED DIELECTRIC PROPERTIES OF

SEVERAL SEMICONDUCTORS, IN THE BULK AND NEAR THE SURFACE, BY MEANS OF INELASTIC LASER LIGHT SCATTERING SPECTROSCOPY, AND TO STUDY ELEMENTARY EXCITATIONS THAT CONTRIBUTE TO THE DIELECTRIC PROPERTIES SUCH AS PHONONS, BULK AND SURFACE POLARITONS, PLASMONS, AND LOW-LYING SINGLE PARTICLE ELECTRONIC EXCITATIONS. HOW WORK CONTRIBUTES-THE FAR INFRARED DIELECTRIC (OPTICAL) PROPERTIES OF THESE SEMICONDUCTORS ARE IMPORTANT TO THE DEVELOPMENT OF INFRARED DETECTORS, SOLID STATE LASERS, INTEGRATED OPTICS AND ELECTRO-OPTICAL TECHNIQUES AND DEVICES CONCEPTS.

APPROACH: (U) LASER RAMAN SPECTROSCOPY UTILIZING TUNABLE DYE LASERS IS BEING USED TO PROBE THE FAR INFRARED PROPERTIES OF SEMICONDUCTORS. FOR THE STUDY OF THE SURFACE LAYERS OF III-V AND II-VI COMPOUND SEMICONDUCTORS, BACK SCATTERING RAMAN SPECTROSCOPY IS BEING USED. FOR THE STUDY OF SURFACE POLARITONS, THIN FILM LAYERED STRUCTURES ARE BEING USED. A COMPUTER-CONTROLLED SPECTROMETER WHICH IS CAPABLE OF EXTREMELY LONG TIME SIGNAL AVERAGING AND DIGITAL PROCESSING IS BEING UTILIZED TO DETECT VERY WEAK RAMAN SCATTERING. THE BEHAVIOR OF SURFACE POLARITONS, PLASMONS AND PHONONS IS BEING RELATED TO THE OPTICAL PROPERTIES AND ELECTRONIC STRUCTURE OF SUCH MATERIALS AS (HG, CD)TE, PBTE, GETE, GAAS, GAP, INSB, INAS AND RELATED SEMICONDUCTING COMPOUNDS AND ALLOYS.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DF047080

TITLE: (U) ELECTRON BEAM SWITCHING EXPERIMENT

PERFORMING ORGANIZATION
UNIVERSITY OF CALIFORNIA
BERKELEY, CA 94720

RESPONSIBLE GOVT ORGANIZATION
DEFENSE NUCLEAR AGENCY
WASHINGTON, D. C. 20305

PRINCIPAL INVESTIGATOR
ROSTOKER, N

ASSOCIATE INVESTIGATOR
RYNN, N

TELEPHONE NUMBER
714-833-7095

CONTRACT/GRANT NUMBER
DNA 001-74-C-0056

PERFORMANCE METHOD
CONTRACT

CONTRACT/GRANT AMOUNT
$ 99,000

DATE OF SUMMARY
26 MAR 76

START DATE
SEP 75

ESTIMATED COMPLETION DATE
NOV 76

KIND OF SUMMARY
NEW

SUMMARY SECURITY
UNCLASSIFIED

WORK SECURITY
UNCLASSIFIED

SCIENTIFIC AND TECHNOLOGICAL AREAS
005800 ENERGY STORAGE
005500 ELECTRICITY AND MAGNETISM
013000 PLASMA PHYSICS

PROGRAM ELEMENT:
62704H

PROJECT NO:
T99QAXL

TASK NUMBER:
A014

KEYWORDS: (U) (U) ELECTRON BEAM ;(U) ENERGY STORAGE ;(U) SWITCHING ;(U) PULSED RADIATION ;(U) X-RAY PRODUCTION

OBJECTIVE: (U) PROPOSED RESEARCH WILL BE EVALUATING ENERGY STORAGE DEVICES THAT INVOLVE ACCUMULATION OF ELECTRONS IN A MAGNETIC TRAP AND THE RAPID RELEASE OF THE ENERGY BY MAGNETIC SWITCHING.

APPROACH: (U) SIGNIFICANT RESULTS HAVE BEEN OBTAINED WITH A SMALL SCALE EXPERIMENT INVOLVING A THERMIONIC INJECTOR AND FAST MAGNETIC COMPRESSION. THE BASIC PRINCIPLE OF THE METHOD HAS NOW BEEN ESTABLISHED. FURTHER STUDIES OF THE SYSTEM ARE REQUIRED FOR PRACTICAL APPLICATIONS. IN ADDITION, THE USE OF A PULSE LINE AND DIODE FOR INJECTION INTO STATIC FIELDS WILL BE EVALUATED. ANOTHER

METHOD TO PRODUCE SHORT INTENSE RADIATION PULSES WILL BE STUDIED WHICH INVOLVES AN ARC PLASMA SOURCE WHICH PRODUCES A PINCH IN A VERY SMALL REGION LIKE AN EXPLODING WIRE.

CONTRACTOR ACCESS: YES                ACCESSION NUMBER: DH002424

TITLE: (U) SPARK GAP EXPERIMENT

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| PERFORMING ORGANIZATION<br>UNIVERSITY OF CALIFORNIA<br>IRVINE, CA 92717 | RESPONSIBLE GOVT ORGANIZATION<br>DEFENSE NUCLEAR AGENCY<br>WASHINGTON, D. C. 20305 |
| PRINCIPAL INVESTIGATOR<br>ROSTOKER, N | ASSOCIATE INVESTIGATOR |
| TELEPHONE NUMBER<br>714-833-6949 | CONTRACT/GRANT NUMBER<br>DNA001-77-C-0003 |
| PERFORMANCE METHOD<br>CONTRACT | CONTRACT/GRANT AMOUNT<br>$ 98,000 |

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|---|---|---|
| DATE OF SUMMARY<br>15 NOV 76 | START DATE<br>JAN 76 | ESTIMATED COMPLETION DATE<br>NOV 77 |
| KIND OF SUMMARY<br>NEW | SUMMARY SECURITY<br>UNCLASSIFIED | WORK SECURITY<br>UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS
013000 PLASMA PHYSICS
013200 POWER SOURCES
005500 ELECTRICITY AND MAGNETISM

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 62704H | T99QAXL | A014 |

KEYWORDS: (U) (U) HIGH DENSITY Z-PINCH ;(U) GAS PUFF JET;(U) LASER SCATTERING SYSTEM ;(U) VACUUM SPARK GAP

OBJECTIVE: (U) TO DETERMINE SCALING LAWS FOR RADIATION PRODUCED BY THE HIGH DENSITY Z-PINCH OF EITHER A GAS PUFF JET OR A VACUUM SPARK AND TO INVESTIGATE NEW CONCEPTS FOR GAS FLOW REGULATION AND JET FORMATION.

APPROACH: (U) EXPERIMENTS WILL BE CONDUCTED ON A 10 KJ CAPACITOR BANK AND THE RESULTS COMPARED WITH EXPERIMENTS PREVIOUSLY CONDUCTED AT UCI AT LOWER ENERGY LEVELS AND WITH SIMILAR PUFF GAS WORK BEING CONDUCTED AT PHYSICS INTERNATIONAL CO.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DH002920

TITLE: (U) GASEOUS DISCHARGE EXPERIMENT

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| PERFORMING ORGANIZATION<br>UNIVERSITY OF CALIFORNIA<br>IRVINE, CA | RESPONSIBLE GOVT ORGANIZATION<br>DEFENSE NUCLEAR AGENCY<br>WASHINGTON, D. C. 20305 |
| PRINCIPAL INVESTIGATOR<br>ROSTOKER, N | ASSOCIATE INVESTIGATOR<br>FISHER, A |
| TELEPHONE NUMBER | CONTRACT/GRANT NUMBER<br>DNA001-77-C-0003 |
| PERFORMANCE METHOD<br>CONTRACT | CONTRACT/GRANT AMOUNT<br>$ 78,410 |

| DATE OF SUMMARY | START DATE | ESTIMATED COMPLETION DATE |
|---|---|---|
| 20 DEC 77 | OCT 76 | NOV 77 |

| KIND OF SUMMARY | SUMMARY SECURITY | WORK SECURITY |
|---|---|---|
| NEW | UNCLASSIFIED | UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 013200 | POWER SOURCES |
| 013000 | PLASMA PHYSICS |
| 005500 | ELECTRICITY AND MAGNETISM |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 62704H | T99QAXL | A014 |

KEYWORDS: (U) (U) IMPLODING HOLLOW CYLINDER ;(U) Z-PINCH GAS JET ;(U) PLASMA DIAGNOSTICS;(U) LASER INTERFEROMETERY ;

OBJECTIVE: (U) TO DETERMINE THE SCALING LAWS GOVERNING THE RADIATIVE OUTPUT FROM Z-PINCH GAS JETS AND IMPLODING HOLLOW CYLINDERS.

APPROACH: (U) CONDUCT EXPERIMENTS UTILIZING A 20 KJ CAPACITOR BANK SYSTEM TO PROVIDE PINCH CURRENTS OF 1 MA AND THEREFORE OBTAIN THE HIGHER POWER SCALING INFORMATION.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DH003413

TITLE: (U) MATERIALS SUPPORT TECHNOLOGY: PHONON AND PHOTON PROCESSES AT SOLID SURFACES

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| PERFORMING ORGANIZATION<br>CALIFORNIA UNIVERSITY IRVINE,<br>CALIF. 92664 | RESPONSIBLE GOVT ORGANIZATION<br>OFFICE OF NAVAL RESEARCH 421<br>ARLINGTON, VA. 22217 |
| PRINCIPAL INVESTIGATOR<br>WALLIS, R F | ASSOCIATE INVESTIGATOR<br>MARADUDIN, A |
| TELEPHONE NUMBER<br>714-833-6393 | CONTRACT/GRANT NUMBER<br>N00014-76-C-0121 |
| PERFORMANCE METHOD<br>CONTRACT | CONTRACT/GRANT AMOUNT<br>$ 50,000 |

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|---|---|---|
| DATE OF SUMMARY<br>03 AUG 79 | START DATE<br>JUL 75 | ESTIMATED COMPLETION DATE<br>SEP 78 |
| KIND OF SUMMARY<br>COMPLETION | SUMMARY SECURITY<br>UNCLASSIFIED | WORK SECURITY<br>UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS

| | |
|---|---|
| 017000 | WAVE PROPAGATION |
| 012000 | OPTICS |
| 015700 | SOLID STATE PHYSICS |

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61153N | RR01102 | RR0110203 |

KEYWORDS: (U) (U) SURFACES ;(U) PHOTONS ;(U) PHONONS ;(U) SOLID STATE ;

OBJECTIVE: (U) ELECTRONIC DEVICE WORK, MATERIALS PREPARATION, AND CRYSTAL GROWTH ARE ALL AREAS WHERE IMPROVED KNOWLEDGE OF SURFACES WILL LEAD TO ENHANCED NAVAL CAPABILITIES. THIS STUDY OF INTERACTIONS OF PHONONS AND PHOTONS WITH SURFACES IS ONE WAY TO IMPROVE OUR KNOWLEDGE OF SURFACES.

APPROACH: (U) THIS WORK TREATS THEORETICALLY THE LATTICE DYNAMICAL PROPERTIES AND THE OPTICAL PROPERTIES OF FREE SURFACES. THE STUDY OF SURFACES EMPHASIZES LATTICE DYNAMICAL PROPERTIES.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DN123370

TITLE: (U) PLASMA COLLECTIVE ION ACCELERATION

PERFORMING ORGANIZATION
UNIVERSITY OF CALIFORNIA
PHYSICS DEPT IRVINE, CA 92717

RESPONSIBLE GOVT ORGANIZATION
OFFICE OF NAVAL RESEARCH 421
ARLINGTON, VA 22217

PRINCIPAL INVESTIGATOR
FISHER, A

ASSOCIATE INVESTIGATOR
ROSTOKER, N

TELEPHONE NUMBER
714-833-7095

CONTRACT/GRANT NUMBER
N00014-79-C-0560

PERFORMANCE METHOD
CONTRACT

CONTRACT/GRANT AMOUNT
$ 55,695

| DATE OF SUMMARY | START DATE | ESTIMATED COMPLETION DATE |
|---|---|---|
| 23 JUL 80 | JUL 79 | CONT |

| KIND OF SUMMARY | SUMMARY SECURITY | WORK SECURITY |
|---|---|---|
| CHANGE | UNCLASSIFIED | UNCLASSIFIED |

SCIENTIFIC AND TECHNOLOGICAL AREAS
013000 PLASMA PHYSICS
012300 PARTICLE PHYSICS

| PROGRAM ELEMENT: | PROJECT NO: | TASK NUMBER: |
|---|---|---|
| 61153N | RR01107 | RR0110703 |

KEYWORDS: (U) (U) ION BEAMS ;(U) COLLECTIVE ACCELERATION ;(U) ELECTRON BEAMS ;(U) BEAM FRONT ACCELERATION

OBJECTIVE: (U) THE NAVY NEEDS QUANTITATIVE INFORMATION ON METHODS TO GENERATE INTENSE ION BEAMS WITH ENERGIES UP TO 1 GEV FOR DIRECTED ENERGY APPLICATIONS, SOURCES OF INTENSE RADIATION THROUGH IMPACTT WITH TARGETS, NEW SOURCES OF ENERGY VIA INTERACTION WITH PELLETS, ETC. THE ELECTRON BEAM FRONT COLLECTIVE ACCELERATION OF IONS TO BE CARRIED OUT IN THIS CONTRACT HAS THE SCALING CHARACTERISTICS WHICH ARE NECESSARY TO FULFILL THE REQUIREMENT STATED ABOVE.

APPROACH: (U) THE BEAM FRONT OF A HIGH CURRENT RELATIVISTIC ELECTRON BEAM CREATES A VERY STRONG ELECTRIC FIELD CAPABLE OF ACCELERATING IONS TO GEV ENERGIES OVER SHORT DISTANCES.

CONTROLLING THE MOTION OF THE ELECTRON BEAM FRONT OVER DISTANCES OF 10'S OF METERS HAS BEEN A MAJOR PROBLEM IN THE AREA OF COLLECTIVE ACCELERATION. IN THIS CONTRACT, TWO NOVEL CONCEPTS ARE UTILIZED TO ACCOMPLISH THIS: (A) THE USE OF A STRONG LONGITUDINAL MAGNETIC FIELD TO MAXIMIZE THE LENGTH OF PROPAGATION AND (B) THE USE OF A PROGRAMMED, EXTERNALLY GENERATED PLASMA TO PROVIDE THE CHARGE NEUTRALIZATION NEEDED TO PROPAGATE THE SPACE CHARGE LIMITED INTENSE BEAM CURRENT FRONT.

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DN975487

TITLE: (U) THEORETICAL RESEARCH ON LINERS

PERFORMING ORGANIZATION
UNIVERSITY OF CALIFORNIA,
IRVINE DEPT. OF PHYSICS IRVINE,
CA 92717

RESPONSIBLE GOVT ORGANIZATION
NAVAL RESEARCH LABORATORY
(4700) WASHINGTON, D.C. 20375

PRINCIPAL INVESTIGATOR
ROSTOKER, N

ASSOCIATE INVESTIGATOR

TELEPHONE NUMBER
714-833-6949

CONTRACT/GRANT NUMBER
N00014-75-C-0310

PERFORMANCE METHOD
CONTRACT

CONTRACT/GRANT AMOUNT
$ 14,003

DATE OF SUMMARY
15 FEB 80

START DATE
OCT 78

ESTIMATED COMPLETION DATE
FEB 80

KIND OF SUMMARY
TERMINATED

SUMMARY SECURITY
UNCLASSIFIED

WORK SECURITY
UNCLASSIFIED

SCIENTIFIC AND TECHNOLOGICAL AREAS
013000 PLASMA PHYSICS

PROGRAM ELEMENT:
61153N

PROJECT NO:
R0109R

TASK NUMBER:
RR0110941

KEYWORDS: (U) (U) LPS VOL-1 ;(U) PLASMA PHYSICS ;(U) PULSED POWER;

OBJECTIVE: (U) TO PERFORM THEORETICAL STUDIES UPON THE DYNAMICS OF COLLAPSING METALLIC LINERS INCLUDING THE ROTATION OF THE INSIDE ?BOUNDARY. IN ADDITION, THEORETICAL STUDIES AIMED AT UNDERSTANDING THE ?INTERACTION BETWEEN CONTAINED PLASMAS AND LINER SURFACES WERE ?STUDIED. THE OVERALL OBJECTIVE IS TO CONTRIBUTE TO STUDIES OF THE ?FEASIBILITY OF PLASMA HEATING VIA LINER COMPRESSION. ? ?

APPROACH: (U) THIS PROGRAM UTILIZED PRIMARILY ANALYTICAL TECHNIQUES TO STUDY THE STABILITY OF LINER SURFACES. THEROETICAL ?STUDIES WERE UNDERTAKEN OF THE REVERSED-FIELD PLASMA CONFIGURATION. ?THE PROGRAM STUDIED SPECIFIC ELECTRON BEAM

CONFIGURATIONS WHERE B0 IS ?ABSENT AND ADDRESSED THE GENERAL PROBLEM OF FORCE-FREE ?CONFIGURATIONS. ? ?

CONTRACTOR ACCESS: YES ACCESSION NUMBER: DN980182